

## CLAIMS

1           1.     A general purpose computer system having multiple nodes, comprising:  
2                     at least one processor executing method acts to promote tolerance of  
3                     faults in the system, the method acts comprising:  
4                         based at least in part on the faults, determining a set of nodes;  
5                     and  
6                         using nodes in the set of nodes only as points on routing paths of  
7                     messages, and not using any node in the set of nodes for sending or  
8                     receiving messages.

1           2.     The system of Claim 1, wherein the set is a lamb set.

1           3.     The system of Claim 2, wherein the act of determining undertaken by  
2                     the processor includes:  
3                         finding small sets of partitions of candidate lamb nodes, each partition  
4                     including a representative node.

1           4.     The system of Claim 3, wherein the act of finding undertaken by the  
2                     processor includes:

3 partitioning nodes in the system into maximal intervals of sequential  
4 nodes, no node in an interval being a faulty node.

1 5. The system of Claim 4, wherein the act of finding undertaken by the  
2 processor further includes:

3 returning at least some intervals as at least one set of partitions.

1 6. The system of Claim 3, wherein the act of determining undertaken by  
2 the processor includes:

3 determining a reachability from at least one representative node to at  
4 least another representative node; and

5 using the reachability to establish a solution set, such that any node in  
6 the solution set can reach any other node in the solution set in at most k  
7 rounds.

1 7. The system of Claim 6, wherein the act of determining a reachability  
2 undertaken by the processor includes:

3 computing at least one reachability matrix, using the solution set.

1           8.     The system of Claim 7, wherein the act of determining a reachability  
2 undertaken by the processor further includes:  
3           computing at least one intersection matrix.

1           9.     The system of Claim 8, wherein the act of determining a reachability  
2 undertaken by the processor further includes:  
3           returning at least one product of at least one reachability matrix and at  
4           least one intersection matrix.

1           10.    The system of Claim 6, wherein k equals two.

1           11.    The system of Claim 6, wherein the act of determining undertaken by  
2 the processor includes:  
3           minimizing a solution set using at least one weighted graph G.

1           12.    The system of Claim 11, wherein the weighted graph is a weighted  
2 bipartite graph.

1           13.    The system of Claim 11, wherein the act of minimizing undertaken by  
2 the processor includes:  
3           finding at least one vertex cover C of the graph G.

1           14.    The system of Claim 13, wherein the act of minimizing undertaken by  
2   the processor further includes:  
3           using selected elements of the vertex cover C, establishing the lamb set.

1           15.    The system of Claim 1, wherein membership in the set of nodes  
2   depends at least partially on a number of processors in a node that are malfunctioning  
3   or not functioning.

1           16.    A computer program device comprising:  
2           a computer program storage device readable by a digital processing  
3   apparatus; and  
4           a program on the program storage device and including instructions  
5   executable by the digital processing apparatus for promoting fault tolerance in a multi-  
6   node system, the program comprising:  
7           means for designating a lamb set of nodes in the multi-node system to  
8   be used for routing messages within the system.

1           17.    The device of Claim 16, wherein the lamb set of nodes contains nodes  
2   that are used only in messages routes.

1           18.    The device of Claim 16, further comprising means for finding small sets  
2           of partitions of prospective lamb nodes, each partition including a representative node.

1           19.    The device of Claim 18, wherein the means for finding includes:  
2                    means for partitioning nodes in the system into maximal intervals of  
3           sequential nodes, no node in an interval being a faulty node.

1           20.    The device of Claim 19, wherein the means for finding includes:  
2                    means for returning at least some intervals as at least one set of  
3           partitions.

1           21.    The device of Claim 18, wherein the means for designating includes:  
2                    means for determining a reachability from at least one representative  
3           node to at least another representative node; and  
4                    means for using the reachability to establish a solution set, such that any  
5           node in the solution set can reach any other node in the solution set in at most  
6           k rounds.

1           22.    The device of Claim 21, wherein the means for designating includes:  
2                    means for computing at least one reachability matrix;  
3                    means for computing at least one intersection matrix; and

4 means for returning at least one product of at least one reachability  
5 matrix and at least one intersection matrix.

1 23. The device of Claim 21, wherein k equals two.

1 24. The device of Claim 18, wherein the means for designating includes:  
2 means for minimizing a solution set using at least one weighted graph  
3 G.

1 25. The device of Claim 24, wherein the weighted graph is a weighted  
2 bipartite graph.

1 26. The device of Claim 24, wherein the means for minimizing includes:  
2 means for finding at least one vertex cover C of the graph G.

1 27. The device of Claim 26, further comprising:  
2 means for using selected elements of the vertex cover C to establish the  
3 lamb set.

1           28.    The device of Claim 16, wherein membership in the lamb set of nodes  
2 depends at least partially on a number of processors in a node that are malfunctioning  
3 or not functioning.

1           29.    A method for promoting fault tolerance in a multi-node system,  
2 comprising the acts of:  
3                for each of k rounds, finding multiple partitions of nodes, each partition  
4 having a representative node;  
5                for each representative node, determining whether the node can reach at  
6 least one predetermined other representative node within a predetermined  
7 criteria;  
8                minimizing the number of nodes and/or partitions using a weighted  
9 graph to establish a routing set of nodes; and  
10               returning the routing set of nodes for use thereof in routing messages  
11 through the system in the presence of one or more node and/or link faults.

1           30.    The method of Claim 29, wherein the number of rounds is at most two.

1           31.    The method of Claim 29, wherein the number of rounds is two and only  
2 two.

1           32.    The method of Claim 29, wherein the weighted graph accounts for at  
2   least one node weight, the node weight being based at least on a number of operational  
3   processors in the node.

1           33.    The method of Claim 29, wherein the routing set of nodes is a lamb set  
2   containing nodes that are used only for routing messages.

1           34.    The method of Claim 29, further comprising finding small sets of  
2   partitions of prospective lamb nodes, each partition including a representative node.

1           35.    The method of Claim 34, comprising partitioning nodes in the system  
2   into maximal intervals of sequential nodes, no node in an interval being a faulty node.

1           36.    The method of Claim 35, comprising returning at least some intervals as  
2   at least one set of partitions.

1           37.    The method of Claim 29, wherein the act of determining whether the  
2   node can reach at least one predetermined other node comprises:

3                   determining a reachability from at least one representative node to at  
4   least another representative node; and



5 using the reachability to establish the routing set, such that any node in  
6 the routing set can reach any other node in the routing set in at most k rounds.

1 38. The method of Claim 37, wherein the act of determining whether the  
2 node can reach at least one predetermined other node comprises:  
3 computing at least one reachability matrix;  
4 computing at least one intersection matrix; and  
5 returning at least one product of at least one reachability matrix and at  
6 least one intersection matrix.

1 39. The method of Claim 29, wherein the act of minimizing includes:  
2 finding at least one vertex cover of the weighted graph; and  
3 using selected elements of the vertex cover to establish the routing set.

1 40. The method of Claim 29, wherein the weighted graph is a weighted  
2 bipartite graph.